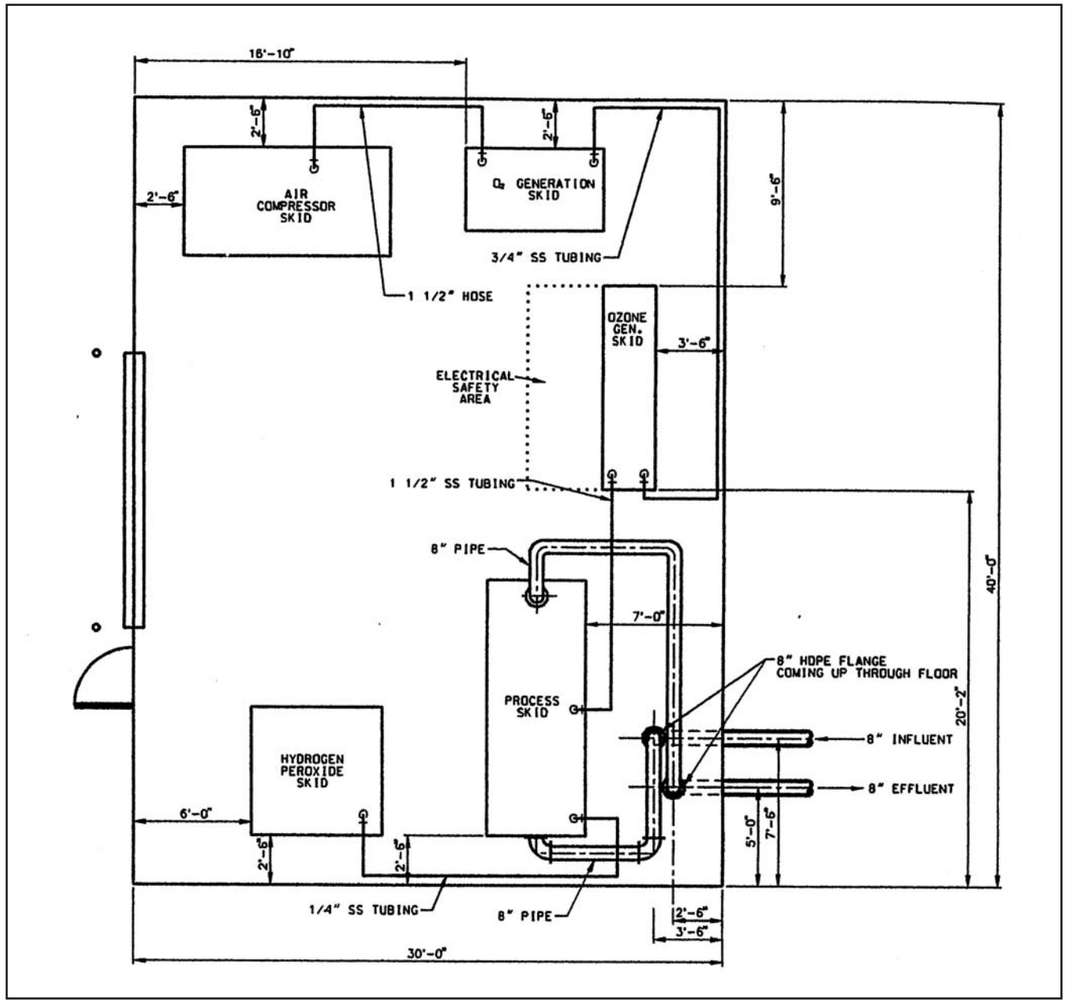
AOP System Layout



US Army Corps
Of Engineers
Kansas City District

FACTSheet
Former Nebraska Ordnance Plant ▪ Mead, Nebraska

January 2007

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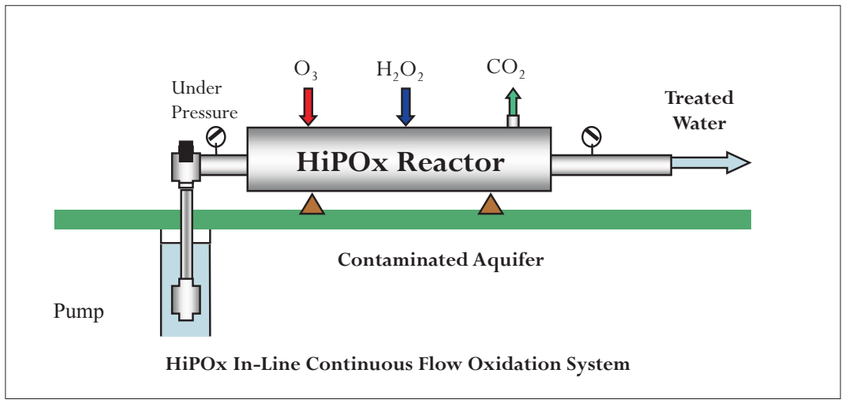
Mead NOP Advanced Oxidation Process Safety Information

Introduction

Increasing awareness of health and safety issues has occurred in recent years as a natural outgrowth of operational and maintenance experience in water treatment facilities. Therefore, safety is a primary consideration in design and installation of the Mead Advanced Oxidation Process (AOP) system for treating VOC contaminated groundwater. The health and safety requirements identified in Occupational Safety and Health Administration (OSHA) 29 CFR 1910.120, 1910.145 and United Stated Army Corps of Engineers (USACE) Safety Guidance EM 385-1 must also be satisfied.

The HiPOx™ (High Pressure Oxidation) Technology

This innovative HiPOx technology is a continuous, in-line, at pressure advanced oxidation process for the destruction of waterborne volatile organic compounds (VOCs). The process uses industry familiar Ozone (O3) and Hydrogen Peroxide (H2O2) chemistry in a uniquely designed oxidation reactor. The reactants are Injected directly into the water stream in precisely controlled ratios, generating hydroxyl radicals (OH), one of the most powerful known oxidizers. These OH radicals attack the covalent bonds in the organic contaminant molecules, progressively



HiPOx In-Line Continuous Flow Oxidation System

See other side

The HiPOx™ (High Pressure Oxidation) Technology (Continued)

reducing these compounds and any resulting intermediate byproducts until the basic atoms ultimately recombine into benign end-products of CO2, H2O and salts (NaCl, etc.).

Contaminant destruction to specified concentrations is achieved as the contaminated groundwater flows through the HiPOx reactor, without breaking pressure head. The hydrogen peroxide and ozone mixture (peroxone) are injected into a closed system. The chemicals are at a precisely controlled ratio and the peroxone and volatile contaminants breakdown into benign end-products prior to leaving AOP treatment plant. The water continues onto the Mead main treatment plant where the influent will be routinely monitored to insure that the dosing rates are at the appropriate levels and the peroxone has been consumed.

Facility Wide Safety

Facility-wide safety will involve protection from hazards associated with handling oxidants (hydrogen peroxide and ozone). Each of the constituents in the HiPOx process has associated dangers. Ozone is toxic, and an irritant to the skin, eyes, respiratory tract, and mucous membranes and can be a significant air pollutant. At the Mead AOP plant, the HiPOx process system will have ozone dosage of 8.9 milligrams per liter (mg/L). However, the ozone will be generated and directly injected into the pressure vessel with no handling required. The only ozone hazard would be from a leak of the system. Employees are protected from ozone hazards by routine air monitoring. Also, ozone has a disinfective “fruity” smell that would warn employees of a potential leak. Designated points of ozone “off-gassing” have ozone destruction devices to destroy ozone prior to discharge into the atmosphere. These off-gassing points will be monitored. Ozone monitoring will be ongoing within the treatment building and if an ozone leak is detected an alarm will sound and the HiPOx equipment will be shut down. In addition to this, alarms for high dew point in gas feed to ozone generator, high temperature, high inlet cooling water temperature, and insufficient gas flow to the generator will also provide system and plant shutdown if not acknowledged. Also, alarms for air preparation system failure and ozone monitor failure will provide system and plant shutdown if not acknowledged.

Gaseous Ozone Exposure

OSHA regulations set the exposure limit for ozone at 0.10 ppmv (8 hour TWA) and 0.30 ppmv (short term exposures limit, STEL). Bad seals or excessive fouling of the residual ozone controller (ozone destruction unit) could raise the level of ozone emission in the ambient air. For safety, we will use the STEL as the level that will require immediate action be taken within the treatment plant facility to reduce ozone levels in the work-place atmosphere. Ozone will be monitored within the treatment building to assure that possible leaks of ozone into the atmosphere are detected.

OSHA regulations 29 CFR 1910.145 requires that a notice must be posted at the entrance of the ozonator facility, which states the following:

OZONE WARNING!
IRRITANT GAS
ADEQUATE VENTILATION REQUIRED
AVOID PROLONGED OR REPEATED
BREATHING OF OZONE

Hydrogen peroxide reacts violently with organics and if contacted with body skin, hydrogen peroxide irritates and possibly causes chemical and/or thermal burns on the skin. In contact with eyes, hydrogen peroxide solutions can cause severe injury or even result in blindness. The commercially available hydrogen peroxide solution to be used at the AOP plant is a 35 percent by weight concentration. Protective equipment for storage and handling equipment for hydrogen peroxide will provide safeguards designed according to manufacturer recommended practices. A Safety shower and eye wash will be provided near hydrogen peroxide equipment.

All safe storage and handling practices will be adhered to, including secondary containment. Secondary containment will be provided for the hydrogen peroxide storage area. Safety measures and containment will also apply to the storage of other chemicals such as acid, caustic and catalysts that may be used in the treatment processes. A 6-inch high concrete curb will serve as a containment system to contain any potential leakage and or spills. The collected material will be recycled back to the plant for subsequent treatment.

Other Safety Considerations

Other safety considerations for an AOP system include:

- Room ventilation,
- Safety railing,
- Remote operating consoles,
- Area and sign lighting, and
- Flood protections

The following table lists some of the hazards and hazard mitigation actions identified for the HiPOx system to be installed at the Mead Site.

	Ozone Hazards	Hazard Mitigation
Ozone	Toxic; skin, eye, respiratory tract, mucous membrane irritant	■ Personal Protective Equipment (PPE) ■ Adequate ventilation
	Air Pollutant	■ Treatment and monitoring at discharge points ■ Continuous monitoring of building space to maintain concentrations below regulatory levels
Hydrogen Peroxide	Irritant; potential for chemical burns to skin and eyes	■ Avoid contact with organics; maintain safety shower and eye wash nearby ■ Comply with safe storage and handling requirements ■ Provide secondary containment ■ Personal Protective Equipment (PPE)